

Rapid Deployment of Maintenance and Operations Innovations Program: Past and Current Practice within and beyond Minnesota

MnDOT Office of Maintenance, Minnesota DOT

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1. Background and Goal

Effective delivery of transportation maintenance and operations products and services requires ongoing review and adoption of innovative technologies and practices. Acceptance and adoption of innovative technologies and practices require exposing agency staff at all levels to these innovations through a variety of methods. The method in which a technology or practice is presented has an impact on implementation success. Different

approaches are needed for different innovations based on their nature, scope and potential impacts to delivery of products and services aimed at meeting strategic plans. At the start of 2020, the Minnesota Department of Transportation (MnDOT) did not have a coordinated and comprehensive agencywide program to foster the adoption of maintenance and operations innovations.

In February 2020, MnDOT Operations Division leadership brought forward support toward development and implementation of a program to rapidly deploy innovative technologies and practices across MnDOT districts in support of improving maintenance operations. Implementation of the program is expected to occur by July 1, 2021.

In March 2020, the Office of Maintenance was tasked with developing this program, starting with the performing of background research, including surveys and interviews, to support this effort. Specifically, the research would investigate what has been done before or is being done now—within and beyond MnDOT—to help inform the development and implementation of the new program. The results of this research are presented in this report.

2. Research Findings on Past Efforts

Minnesota DOT's Past Efforts

Prior to 2020, work had been done in MnDOT to address and advance innovation deployment and best practices. These were reviewed to see which might be relevant and helpful to the current effort.

Three past efforts highlighted here are a 2005-2009 best practices program, a 2007 innovation roadmap, and a 2010 innovation culture assessment report.

MnDOT Best Practices Program, MnDOT Operations Division and Engineering Services Division, 2005-2009. Program overview, including participants, processes and a project list, are in [Appendix A](#).

This program described “best practices” as “proven effective processes or tools that are replicable across multiple MnDOT districts or offices.” The goal was to have best practices contribute to better end results for customers, the transportation system or operations, as well as more efficient and productive use of resources.

Participation included division directors, office directors, district engineers and functional groups.

The new 2020 effort has shifted focus away from “best practices” (how is “best” measured or determined?) to rapid development and deployment of innovative solutions.

What is an Innovation Roadmap? MnDOT Research Services Section, 2007. [Appendix B](#).

The roadmap shown in Figure 1 was developed by the Research Services Section within the Office of Investment Management. It was intended to help facilitate the agencywide deployment of research and implementation products as aligned with the MnDOT 2007 R&D Strategic Plan.

What is an Innovation Roadmap?

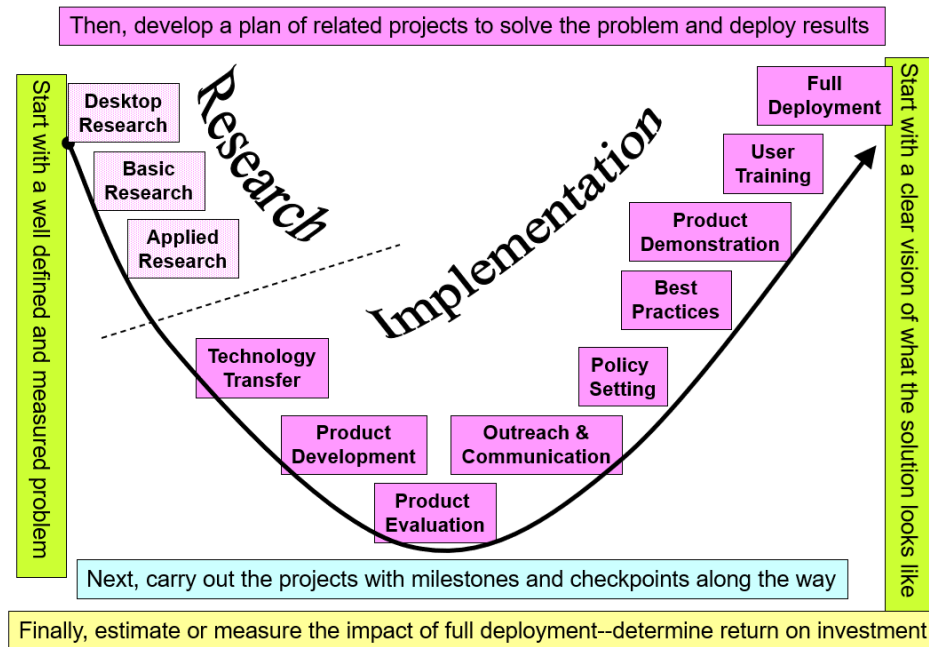


Figure 1. 2007 Innovation Roadmap

[Appendix B](#) includes more details on this roadmap and defines the terms that appear in Figure 1.

The roadmap was a valuable tool with limited implementation. It helps present a picture of the steps necessary to get from the research stage through the development/implementation stage and into the operational environment. In so doing, it distinguishes the many phases of research and development through definitions and a process flow.

Importantly, it considers end-user products and the research and development projects that are necessary for implementing those end-user products.

This roadmap concept has evolved since 2007 toward a focus on measuring product/service levels and life-cycle analysis rather than return on investment. The conceptualization of which steps belong to “research” versus “implementation” has also shifted.

MnDOT’s Innovation Culture Assessment Report, MnDOT Office of Policy, Analysis, Research & Innovation, 2010. [Appendix C](#).

In this effort, MnDOT’s Office of Policy, Analysis, Research & Innovation conducted an internal assessment that aimed to answer three questions through a series of interviews within the agency:

- What are the perceived challenges to a culture of innovation?
- What is needed in the current organizational structure to adopt a culture of innovation?
- How can we design and develop an innovation plan (approach) to meet the strategic needs of MnDOT?

The investigator's findings are presented in three areas:

- **Innovation “currency”** or strengths, including strong leadership vision, positive momentum, pockets of success, and employee leadership development.
- **Situational opportunities and challenges** tied to the agency's diverse and decentralized organizational structure and differing viewpoints on implementing innovation.
- **Big ideas**, such as making innovation visible, establishing the district as the customer, and challenging locked-in ideas, among others.

The findings are further detailed in the report.

Many of the observations in the Innovation Culture Assessment Report remain true 10 years later and reflect the need for continual effort in this area.

Other States' Past Efforts

State DOT innovation was a topic of two synthesis studies conducted over the past decade, one by MnDOT and one by the California Department of Transportation (Caltrans):

- **Developing a Culture of Innovation**, Transportation Research Synthesis of state DOT practice, conducted by MnDOT, 2010. [Appendix D](#).
- **Fostering Innovation within State Departments of Transportation**, Caltrans Preliminary Investigation, 2015.

Each of these reports outlined promising innovation programs of multiple state DOTs across the United States. However, based on follow-up investigation conducted for this study, it was found that many of the programs described in these syntheses have evolved or been replaced by newer initiatives. While each of these syntheses has limited value as a “snapshot in time,” they nevertheless provide a valuable perspective on the long-term interest in innovation.

Current practices at other state DOTs are discussed later in this report.

3. Research Findings on Recent and Current Related Efforts

Efforts within MnDOT: the Office of Maintenance and Beyond

Relevant to this study are recent and current activities within MnDOT that are addressing similar issues. Two are described here, one completed in 2020 by MnDOT Liaison Services and one currently underway by the Office of Research & Innovation.

District Relationships Project, MnDOT Liaison Services, 2020. [Appendix E](#).

This effort sought to determine how MnDOT's Office of Project Management & Technical Support (OPMTS) could better serve the districts by identifying business process improvement opportunities, building and strengthening relationships among MnDOT central office and district project delivery staff, and recommending a framework to address future challenges and opportunities.

The report offers recommendations in the areas of customer service approach, communications, roles/responsibilities, training/learning, process improvements, resources, and implementation prioritization.

Developing an Innovation Strategy for MnDOT, MnDOT Office of Research & Innovation (ORI), 2020 (in progress).

Through this effort, ORI will develop an innovation strategy to ensure that the office provides the support needed to help foster innovation throughout the department. The innovation strategy will be shared with other DOTs as an example of creating a strategic roadmap for fostering a culture of innovation and systemically institutionalizing it within the organization.

The ORI effort described above was initiated around the same time as the Rapid Deployment of Maintenance and Operations Innovations effort and is now underway. While these projects differ in scope, the Office of Maintenance and ORI remain in close contact as both progress in parallel as a means to leverage findings of value to the other.

Discussions with MnDOT Districts

Central to this effort was new outreach and information gathering to determine ideas and approaches to rapid deployment of innovations. This included internal discussion (meeting with MnDOT staff at the central office and districts) and surveys of other states.

The Office of Maintenance held virtual meetings with district leadership, management and supervisory staff in each of the eight districts between May and July 2020.

The agenda included a review of this project and an open discussion on the following topics:

- How to define a best practice.
- How to identify a best practice.
- How to communicate a best practice.
- How to deploy a best practice/what is full deployment?
- Do you have Maintenance and Operations best practice examples to share?

Highlighted results of the discussions with district staff follow. As noted several times in these discussions, there is a distinction between a best practice and an innovation. The discussions focused on innovation more broadly than best practices.

- *How to define a best practice/innovation*
 - Defining “best” was a difficult undertaking. What may be considered best somewhere may not be best (or even beneficial) somewhere else.
 - A best practice should include quality, safety and consistency.
 - The 2005-2009 program definition of best practices was “proven effective processes or tools that are replicable across multiple MnDOT districts or offices.” This definition was presented to meeting participants. There was no opposition to this definition or its intention during discussions.

- *How to identify a best practice/innovation*
 - Innovations can be found anywhere: from other states, other agencies, industries, online, by attending a conference, through conversations across the agency, etc.
- *How to communicate a best practice/innovation*
 - Two-way communication (conversations, interactions, demonstrations, expos) is much more effective than one-way communication (emails, websites).
 - Communication often will not happen on its own. It is important to create opportunities for two-way communication to occur, such as by holding peer exchanges, expos, or standing events for sharing information.
 - Achieving implementation of innovation requires perseverance.
 - Creating an innovative environment includes rewarding innovators (those who go “above and beyond” their regular duties).
- *How to deploy a best practice/innovation. What is full deployment?*
 - A significant barrier to deployment (possibly only a perceived one) is a disconnect in the base level of knowledge/understanding between leadership, management and staff. This knowledge gap may include the how, what and why of an innovation.
 - Insufficient funding can be another barrier to implementing innovations.
 - Communication and training are vital, but there may not be enough supervisory skill/authority to adequately reach staff. For example, is there an ideal minimum ratio of supervisors to staff? Are there too many supervisors or too few?
 - Getting leadership behind an innovation may be required at certain points if an innovation is seen as adversely impacting the agency as a whole in some way.
 - Drawing from peers who have successfully deployed an innovation—and learning how specific implementation pitfalls can be avoided—will help facilitate deployment.
- *Do you have Maintenance and Operations best practice/innovation examples to share?*
 - Table 1 below lists innovations highlighted during MnDOT district meetings. This is a selection of innovations, not an exhaustive list.

Table 1. Innovations Shared During MnDOT District Meetings

Primary Product and Service*	Best Practice/Innovation Idea
All	COVID-19 barrier for six-pack cab truck
All	Crossover staff utilization
All	Determine ideal supervisor-to-staff ratio
BSI&M, R&RM	Beaver dam removal
BSI&M, R&RM, TO&M	Bridge & Road Construction (BARC) fund spending methods
R&RM	Air patch truck utilization
R&RM	Bobcat hopper for pavement patching
R&RM	Cable median barrier spreader
R&RM	Concrete pavement repair methods
R&RM	Driver-assist systems
R&RM	Emulsion tank utilization
R&RM	Equipment sharing and uniformity
R&RM	Fleet management practices
R&RM	Herbicide spray truck utilization
R&RM	Laid-in-place bituminous surface treatment contracts
R&RM	Mastic patching applications
R&RM	Reduce mowing equipment fleet and operators
R&RM	Tree trimming using contracted services
R&RM	Tree trimming using Quick Saw
R&RM	Tunnel washing
R&RM	Wedge paving
S&I	Alternative winter chemical usage
S&I	Better lighting on plow trucks
S&I	Ice breaker applications
S&I	Living snow fence utilization
S&I	Target specific trucks for slurry service over a broadened area
S&I	TowPlow utilizing forestry fire hose spray system
S&I	Winter slurry application
TO&M	Dedicated emergency detour kit

*Maintenance and Operations products and services:

- R&RM Road and Roadside Maintenance
- S&I Snow & Ice
- TO&M Traffic Operations & Maintenance
- BSI&M Bridges/Structures Inspection & Maintenance

Discussions with MnDOT Central Office

Discussions with central office staff included the following sections and units:

- Office of Maintenance
 - Building Services
 - Finance
 - Fleet Management

- Geographic Information Systems
- Operations, Work Zone Safety and Sign-Striping
- Road Weather Technology
- Training: State and Local
- Office of Materials & Road Research

The central office discussions focused on the same questions the district discussions. Highlighted results of the discussions with MnDOT central office sections and units follow.

- *How to define a best practice/innovation*
 - The 2005-2009 program definition of best practices was “proven effective processes or tools that are replicable across multiple MnDOT districts or offices.” This was generally accepted in principle.
- *How to identify a best practice/innovation*
 - Central office interviewees said the same as the MnDOT district interviewees: Innovations come from all possible sources (internal and external, literature, Internet, etc.).
 - Every worker (front-line and management) has their own ideas on what is innovative based on their experience, expertise and perspective.
- *How to communicate a best practice/innovation*
 - People must see things in order to believe them. Supervisors need to give staff “white space” (time to be creative and think outside the box, rather than being told how everything must be done).
 - Have people who have succeeded with an innovation communicate the value and the proof of success.
 - Get in front of the right groups with demonstrations, presentations, and opportunities for one-on-one interaction.
 - Leadership must get behind and support innovations.
 - It is important both to train (how to do something) and to educate (explain why something is done).
- *How to deploy a best practice/innovation. What is full deployment?*
 - Select (and adapt if necessary) an innovation that fits a need based on geography, traffic, budgets, public expectations, etc.
 - Allow flexibility at the local level to meet local needs and requirements. However, this goes hand-in-hand with accountability at the local level.
 - Deployment success can be evaluated by measuring changes in behavior that lead to a different way of delivering a product or service.
 - Is “full deployment” a goal? Is it antithetical to the idea of continuous improvement?
- *Do you have Maintenance and Operations best practice/innovation examples to share?*
 - Table 2 below lists innovations highlighted during MnDOT central office meetings. Again, this is a selection of innovations, not an exhaustive list.

Table 2. Innovations Shared During MnDOT Central Office Meetings

Primary Product and Service*	Best Practice/Innovation Idea
All	Developing shared drive folders
All	Equipment fabrication
All	Reducing temperature set points for facilities
R&RM	Adopt a Highway
R&RM	Mastics
S&I	Alternative winter chemicals
S&I	Coverall salt sheds
S&I	Snowplow Operator Training (SPOT) program
TO&M	Centralized sign production
TO&M	Centralized striping
TO&M	Damage restitution

*Maintenance and Operations products and services:

- R&RM Road and Roadside Maintenance
- S&I Snow & Ice
- TO&M Traffic Operations & Maintenance
- BSI&M Bridges/Structures Inspection & Maintenance

Other State DOTs—Survey and Synthesis

To learn about current innovation practices at other states, MnDOT conducted an email survey of other states in May 2020. The email consisted of the following four questions, which were sent to all members of the American Association of State Highway and Transportation Officials (AASHTO) [Maintenance Committee \(MaC\)](#).

1. Does your agency have an Innovations Program that identifies and applies Best Practices (technologies, processes and/or policies) on a statewide basis to support Operations of Maintenance?
2. How long has this Program been in existence?
3. How are ideas for Best Practices developed, prioritized, selected, and implemented?
4. Who is the main contact from your agency for the Best Practices Program?

Eight states responded to this survey. The survey findings were complemented by a review of a 2018 synthesis study, [Innovation Programs: Inquiry of No Boundaries Member States](#), and the 2015 Caltrans synthesis noted earlier in this report.

Detailed findings from the survey, the No Boundaries synthesis, and a targeted Internet search are compiled in a spreadsheet, [Appendix F](#).

Top-level findings from all of these information sources include the following observations.

- The first question of the survey was, “Does your agency have an Innovations Program that identifies and applies Best Practices (technologies, processes and/or policies) on a statewide basis to support Operations of Maintenance?”
 - Among the eight states that responded to the AASHTO MaC survey:
 - Six responded “yes”: Florida, Louisiana, Michigan, Ohio, Utah, Washington State
 - Two responded “no”: Kansas, Nevada

- Answers were inferred from the 2018 No Boundaries synthesis and the 2015 Caltrans synthesis. From these:
 - Six additional states were identified having programs: Arizona, Connecticut, Missouri, North Dakota, Pennsylvania, Wisconsin
- Some state programs that focus on showcasing innovations are long-established: Ohio DOT’s Team Up showcase began in 1998; Connecticut’s Creative Solutions Program was started in 2005 by the state’s Local Technical Assistance Program; and Missouri’s tool and equipment challenge began in 2007. In contrast, a number of states have programs that are around three years old (Louisiana, Utah, Washington State and Wisconsin).
- Innovation competitions are a common manifestation of innovation programs. Appendix F details the competitions in Connecticut, Ohio, Michigan and Missouri, including:
 - Submission categories and rules
 - Scoring rubrics
 - Award categories
 - Prizes (typically recognition among peers by agency leadership)
- States described how innovation efforts are structured and innovation is fostered in their organizations, particularly with respect to maintenance and operations:
 - Michigan has statewide teams: a Statewide Maintenance Operations Alignment Team that meets monthly and a Maintenance Superintendent Alignment Team that meets quarterly. Stakeholders from each of the seven regions (maintenance engineers, maintenance garage personnel) share many issues, policies, procedures and guidelines, and they innovate best practices for common benefit.
 - Ohio has an Office of Research and Implementation that “supports the entire agency, not just Operations of Maintenance.” Moreover, its Maintenance Division has developed a maintenance manual that describes best practices for its activities.
 - Utah has an Innovations group that is based out of its Research Division. There is an individual who is assigned as the Maintenance representative. This representative works with all of Utah’s Maintenance Stations to help communicate and advance innovation throughout the Maintenance Division.
- North Dakota has an established [Transportation Innovations Program](#) (TRIP), an ongoing program with multiple solicitations annually.
 - Submitted ideas are reviewed and presented, with recommendations made to the North Dakota DOT Executive Office for final decision.
 - TRIP funding is limited to the same areas where agency funds may be used, as laid out under state law; for submissions that are roadway-related, North Dakota DOT attempts to utilize federal aid if possible.
 - Per the [rules and submission guidelines](#), ideas must include a summary, problem statement, implementation approach (with target date), costs, and contact information.
- The federal [State Transportation Innovation Council](#) (STIC) aid program is a channel for states to use federal dollars for implementing innovations.

- The [Pennsylvania STIC](#), formed in 2010, is among the most mature STICs. Wisconsin’s STIC program is also detailed in Appendix F.
- According to FHWA, Minnesota received [six STIC incentive project grants](#) between 2014 and 2019.
- Wisconsin’s Division of Transportation System Development manages its STIC.

4. Findings and Recommendations

Based on all of the findings highlighted in this report, the following lessons, observations, insights are made:

- Communication is a key opportunity. At the same time, it can be the most challenging accomplishment.
- A base level of knowledge must be built between front-line workers, managers and leadership.
- Reward innovators and innovations—invest in marketing winners and successes.
- Success requires persistence and patience. Success may not come easy, and it may not come cheap.

As a next step, a recommended process for Rapid Deployment of Maintenance and Operations Innovations has been drafted ([Appendix G](#)) and is out for review. Key points of this process include:

- How potential innovations are identified
- How consensus on an innovation is reached
- How full deployment is determined
- The role of districts
- The role of the Office of Maintenance
- The role of the Assistant Commissioner for Operations and district engineers

Review and comment from management and executives across MnDOT is currently being sought.

5. Appendices

These appendices follow:

- Appendix A. MnDOT Best Practices Program 2005-2009
- Appendix B. What is a Innovation Roadmap
- Appendix C. MnDOT Innovative Culture Report
- Appendix D. Developing a Culture of Innovation
- Appendix E. District Relationship Project
- Appendix F. Survey and Synthesis of State DOTs
- Appendix G. Rapid Deployment of Maintenance & Operations Innovations Program